MALARIA

NAVY ENVIRONMENTAL AND PREVENTIVE MEDICINE UNIT #2

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COURSE OBJECTIVES

- BASIC UNDERSTANDING OF MALARIA
  - EPIDEMIOLOGY
  - SYMPTOMS
  - DIAGNOSIS
  - TREATMENT
  - PREVENTION

WHAT IS IT?

- A MOSQUITO-BORNE INFECTIOUS DISEASE OF THE TROPICS, SUBTROPICS, AND FRINGES OF TEMPERATE FORESTS .
  - FOUND IN LATIN AMERICA, CARIBBEAN, ASIA, AFRICA, EUROPE
- CAN BE EITHER ACUTE OR CHRONIC

WHAT IS IT?

- CAUSED BY PROTOZOAN PARASITE GENUS *PLASMODIUM*

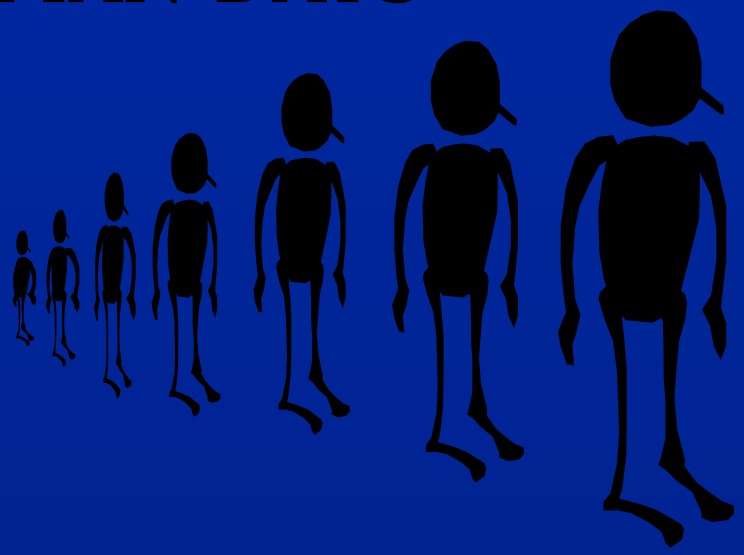
- FOUR SPECIES:
  - *P FALCIPARUM*
  - *P VIVAX*
  - *P OVALE*
  - *P MALARIAE*

WHY THE CONCERN?

- MOST PREVALENT DISEASE IN THE WORLD
  - 2.1 BILLION LIVE IN MALARIOUS AREAS
  - 100-300 MILLION NEW CASES ANNUALLY
  - 1-3 MILLION DEATHS ANNUALLY
- POTENTIALLY LETHAL DISEASE
- SERIOUS THREAT TO MILITARY OPS

HISTORY

- WWI NAVAL FORCES
  - 4,746 NEW HOSPITAL ADMISSIONS
  - 68,373 LOST MAN-DAYS
  - 7 DEATHS

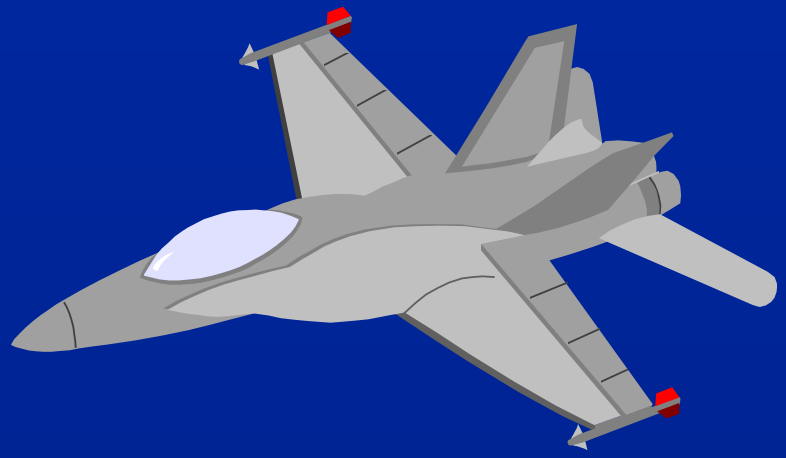


HISTORY

- WWII NAVAL FORCES
  - 111,675 NEW HOSPITAL ADMISSIONS
  - 3,310,800 LOST MAN-DAYS
  - 90 DEATHS
  - 5,332 (AVG) DAILY SICK LIST IN PACIFIC

HISTORY

- VIETNAM WAR
  - 21,695 NEW ADMISSIONS
  - 187,478 LOST MAN-DAYS
  - 46 DEATHS



TRANSMISSION

- MAN IS THE ONLY IMPORTANT RESERVOIR

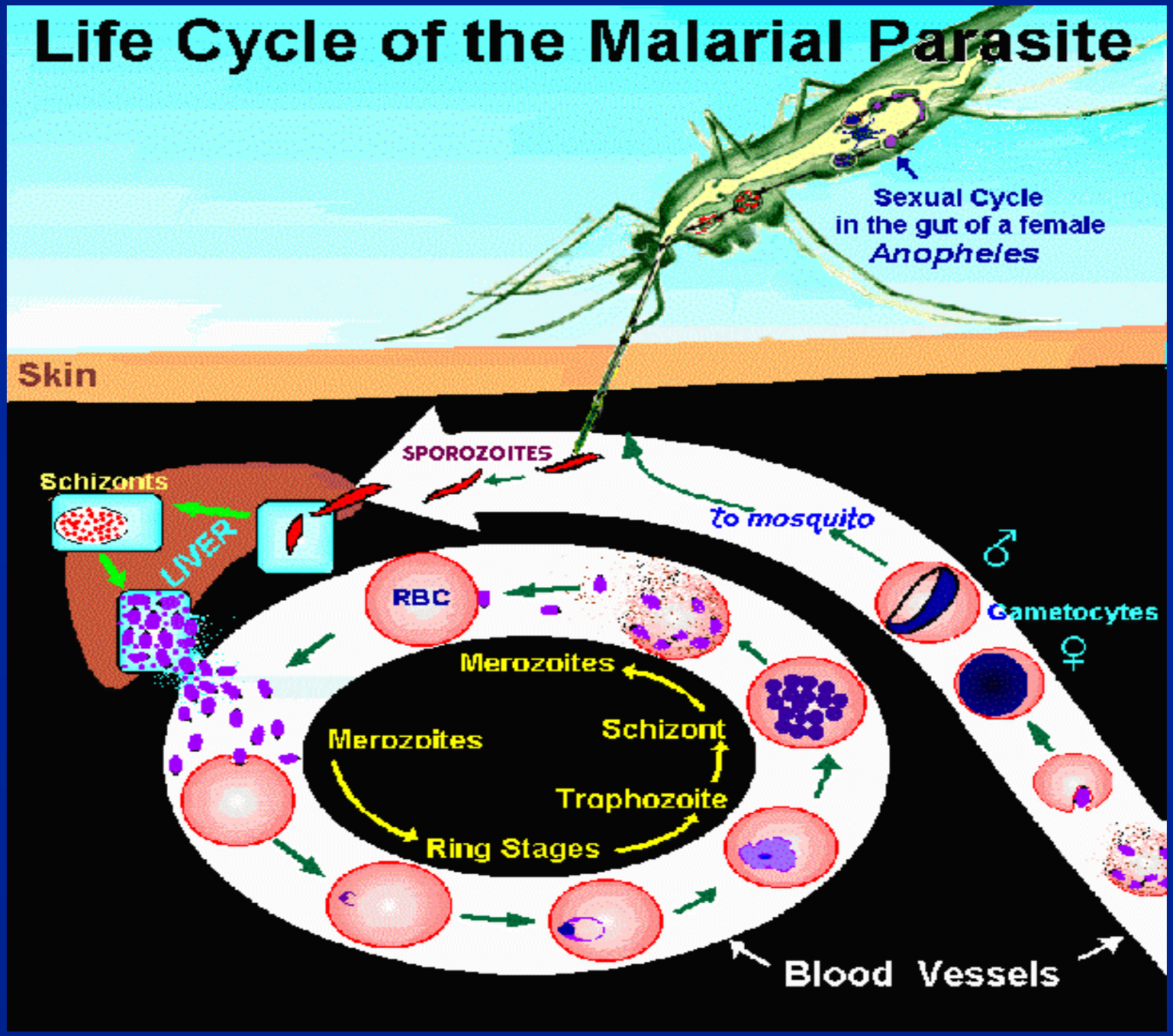
- VECTOR IS FEMALE ANOPHELES MOSQUITO
  - **TEMPERATURE**
  - **RAINFALL**
  - ALTITUDE
  - TERRAIN

TRANSMISSION

- VECTOR *ANOPHELES*
  - BLOOD TRANSFUSION
  - CONTAMINATED NEEDLE
  - ORGAN TRANSPLANT
  - CONGENITAL

SUSCEPTIBILITY

- UNIVERSAL SUSCEPTIBILITY
- NO ABSOLUTE IMMUNITY
  - PARTIAL IMMUNITY IN AREAS OF HIGH ENDEMICITY


Life Cycle of the Malarial Parasite
Sexual Cycle
in the gut of a female
Anopheles
Skin
SPOROZOITES
Schizonts
LIVER
to mosquito
RBC
Gametocytes
♂
♀
Merozoites
Merozoites
Schizont
Trophozoite
Ring Stages
Blood Vessels

PATHOGENESIS

- RBC DESTRUCTION
- IMMUNE COMPLEXES AND MEDIATORS
- CAPILLARY PERMEABILITY
- TISSUE HYPOXIA

PLASMODIUM SPECIES

- *P. FALCIPARUM*
  - MOST SEVERE AND PREVALENT
  - 40-60% OF CASES
  - WIDESPREAD CHLOROQUINE RESISTANCE
  - INFECTS RBCs OF ALL AGES: HEAVY PARASITEMIA

PLASMODIUM SPECIES

- P. VIVAX
  - 30-40% OF CASES
  - LIVER PHASE
  - INFECTS YOUNG RBCs: LESS SEVERE THAN FALCIPARUM
- OVALE
  - LIVER PHASE
  - INFECTS YOUNG RBCs
- MALARIAE
  - CAN PERSIST SUBCLINICALLY FOR EXTENDED PERIODS OF TIME
  - INFECTS OLD RBCs

INCUBATION PERIOD

- P. FALCIPARUM 12 DAYS
- P. VIVAX 14 DAYS*
- P. OVALE 14 DAYS*
- P. MALARIAE 30 DAYS

* MAY BE 8 - 10 MONTHS OR LONGER FOR SOME STRAINS

ACUTE SYMPTOMS

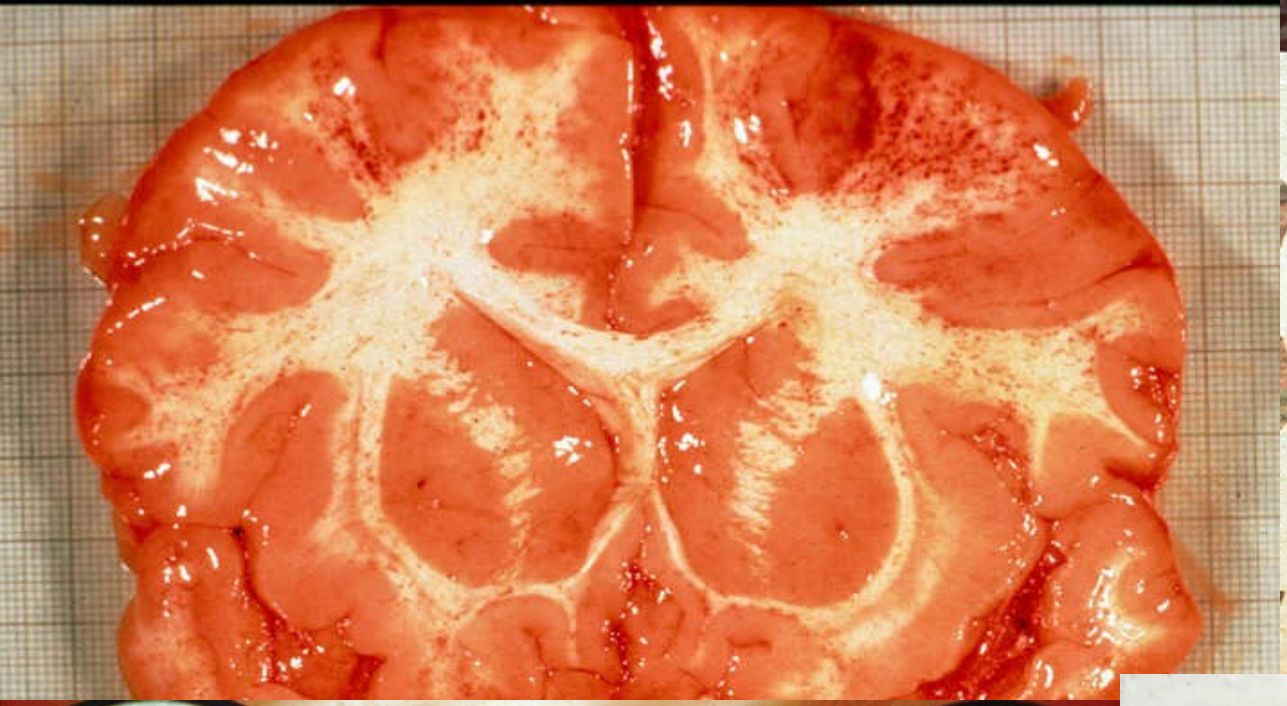
- CLASSICAL CYCLIC PAROXYSM:
  - COLD STAGE: CHILLS AND SHAKING
  - HOT STAGE: WARM, HEADACHE, VOMITING
  - SWEATING STAGE: WEAKNESS
  - FEEL WELL FOR PERIOD OF TIME, THEN CYCLE REPEATS ITSELF

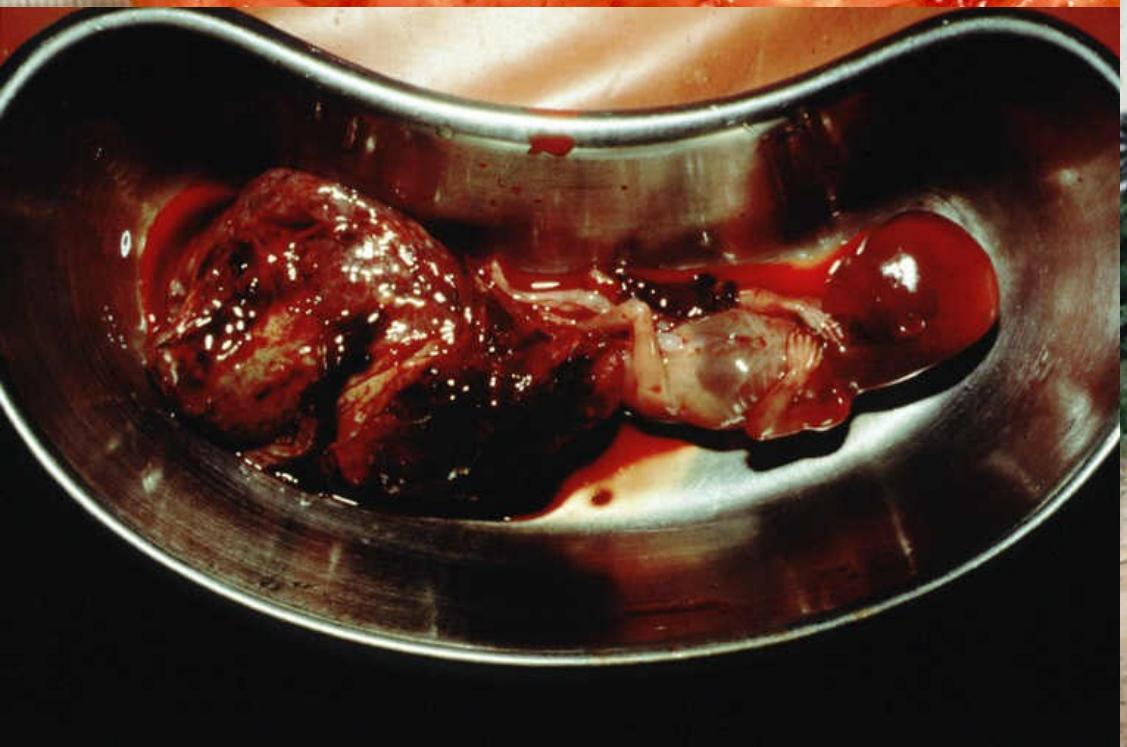
PRESENTATION

- FEVER 97%
- CHILLS 97%
- HEADACHE 97%
- NAUSEA OR VOMITING 62%
- ABDOMINAL PAIN 56%
- MYALGIA 50%
- BACKACHE 9%
- DARK URINE 3%

COMPLICATED MALARIA

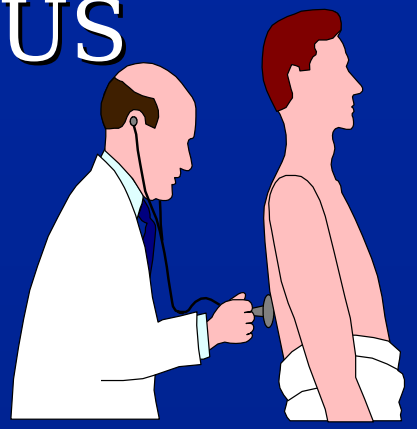
- HYPERPARISITEMIA: >3%
- HYPOGLYCEMIA: <60 MG/DL
- SEVERE ANEMIA:
  - HCT < 21% OR RAPIDLY FALLING HCT
- RENAL FAILURE
- HYPONATREMIA
- CEREBRAL MALARIA
- PROLONGED HYPOTHERMIA
- HIGH OUTPUT VOMITING OR DIARRHEA
- PREGNANCY



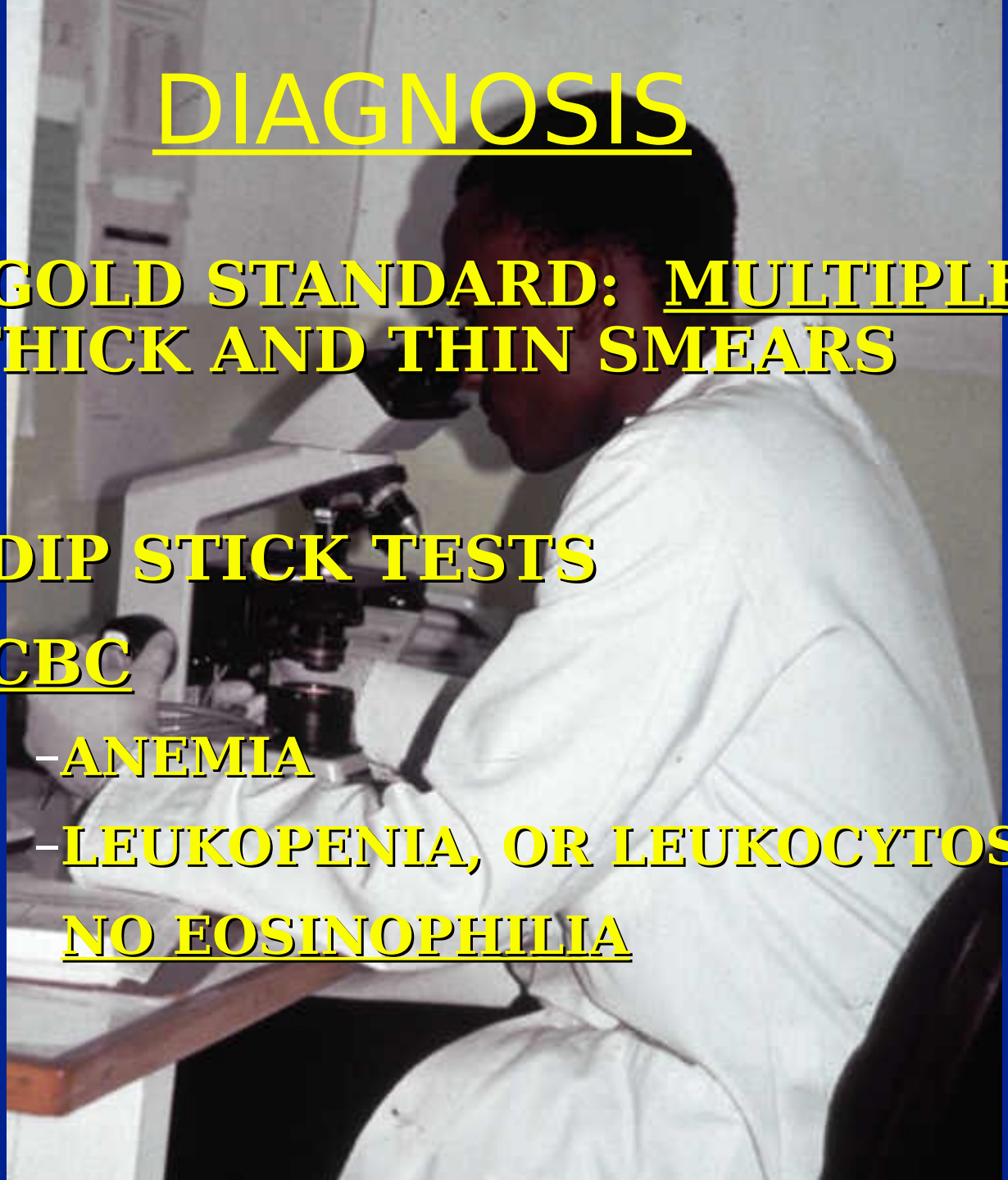


SIGNS IN ACUTE INFECTION

- SLIGHTLY ILL TO IN DISTRESS
- ALERT TO UNCONSCIOUS
- FEVER

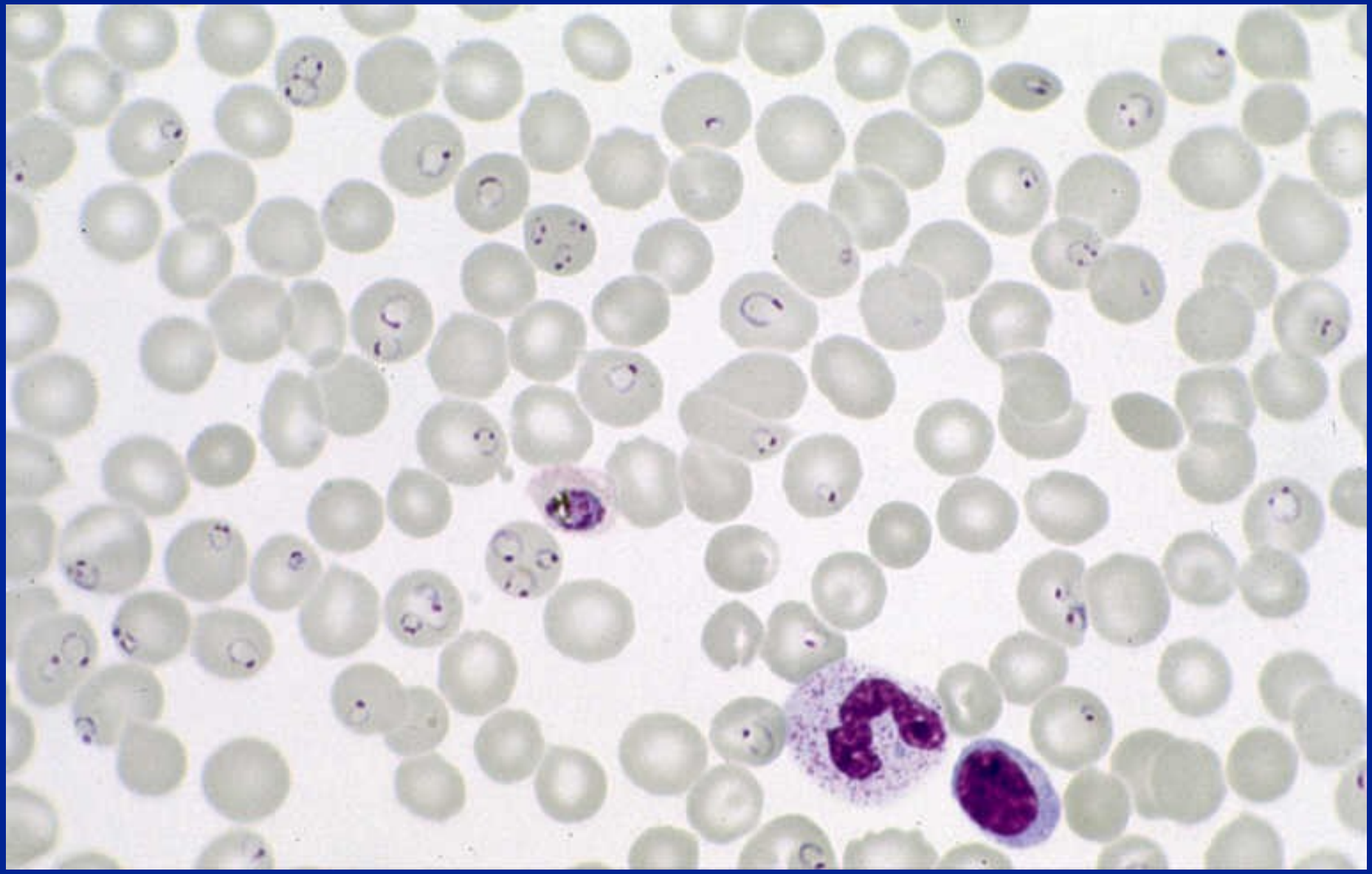


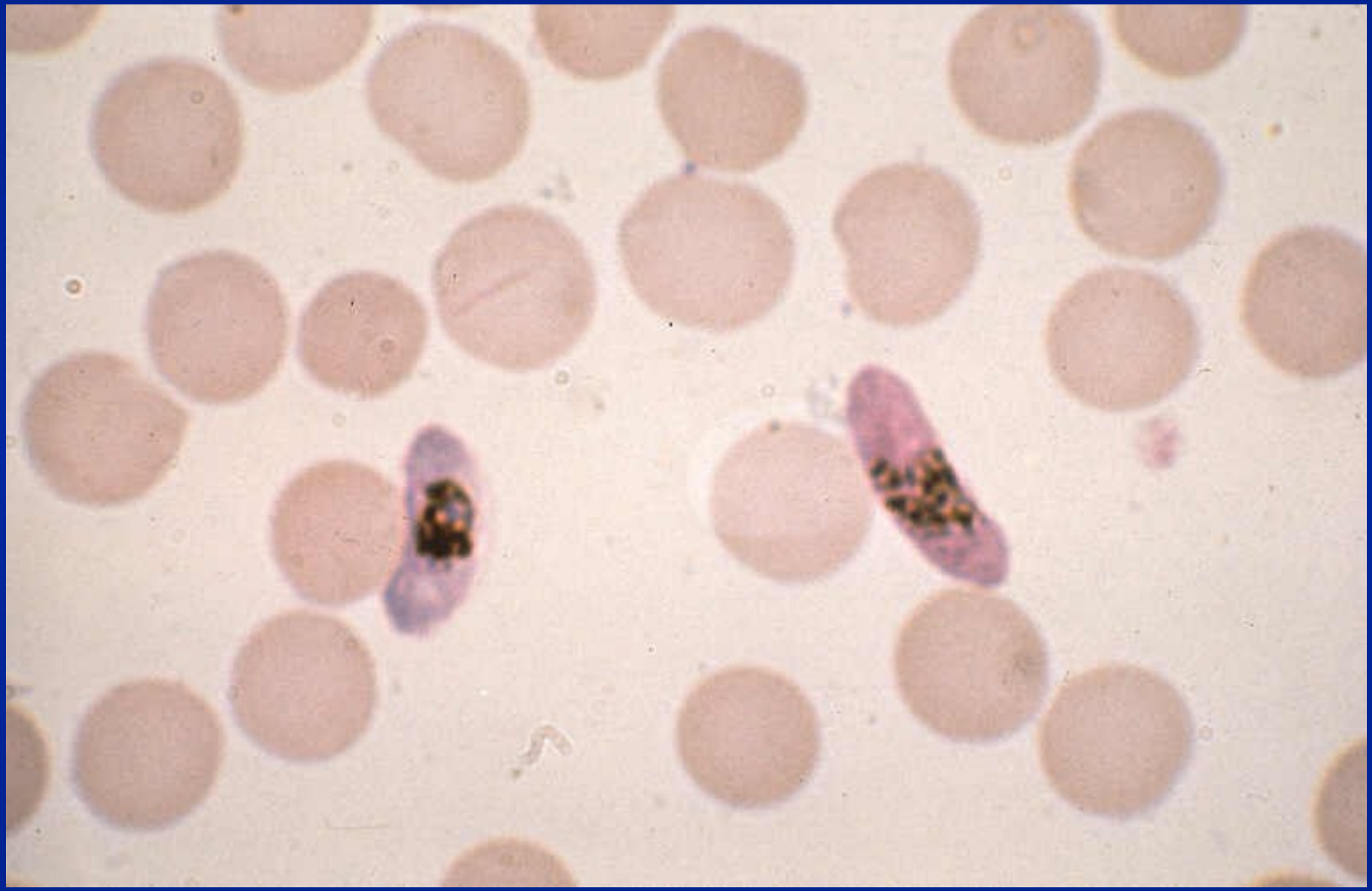
DIAGNOSIS



- **GOLD STANDARD: MULTIPLE THICK AND THIN SMEARS**
- **DIP STICK TESTS**
- **CBC**
  - **ANEMIA**
  - **LEUKOPENIA, OR LEUKOCYTOSIS**

NO EOSINOPHILIA





TREATMENT

- CHLOROQUINE SENSITIVE INFECTIONS:
  - CHLOROQUINE BASE 600 MG (2 TABS) P.O. INITIALLY, THEN 300 MG (1 TAB) IN 6 HRS. AND QD FOR 2 DAYS

TREATMENT

- UNCOMPLICATED CHLOROQUINE RESISTANT INFECTIONS:
  - QUININE 650 MG PO TID X 3 DAYS AND DOXYCYCLINE 100 MG PO BID X 7 DAYS, OR
  - MEFLOQUINE 1000-1500 MG PO ONCE
- COMPLICATED OR SEVERE INFECTIONS
  - IV QUINIDINE OR QUININE

TREATMENT

- VIVAX AND OVALE THERAPY SHOULD INCLUDE PRIMAQUINE 15MG PO QD X 14 DAYS

OPTIMAL TREATMENT APPROACH

- RAPID CASE IDENTIFICATION
- RAPID PARASITOLOGICAL CLASSIFICATION
- RAPID INITIATION OF THERAPY
- RAPID INITIATION OF SUPPORTIVE CARE

CONTROL OF MALARIA

- GLOBAL ERADICATION EFFORTS BY WHO IN 1950s
- EFFORTS NOW FOCUS ON CONTROL vs ERADICATION

POINTS OF ATTACK

1. ATTACK THE PARASITE IN THE HUMAN HOST

2. REDUCE CONTACT BETWEEN HUMANS AND MOSQUITOES

3. DECREASE MOSQUITO POPULATION

ATTACK THE PARASITE IN THE HUMAN HOST

- Treat malaria infections with effective medications
- Use prophylactic drugs to prevent illness and

ATTACK THE PARASITE IN THE HUMAN HOST

- CHEMOPROPHYLAXIS BASED ON CURRENT DRUG RESISTANCE PATTERNS
- ***MEFLOQUINE*** FIRST LINE PROPHYLAXIS
  - Mefloquine 250mg. po q week, 2 wks prior to 4 wks after
- ***DOXYCYCLINE*** AS SECOND LINE DRUG
  - Doxy 100mg. po qd, 2days prior to 4 wks after
- *Primaquine* 15mg. po qd x 14 days terminal prophylaxis

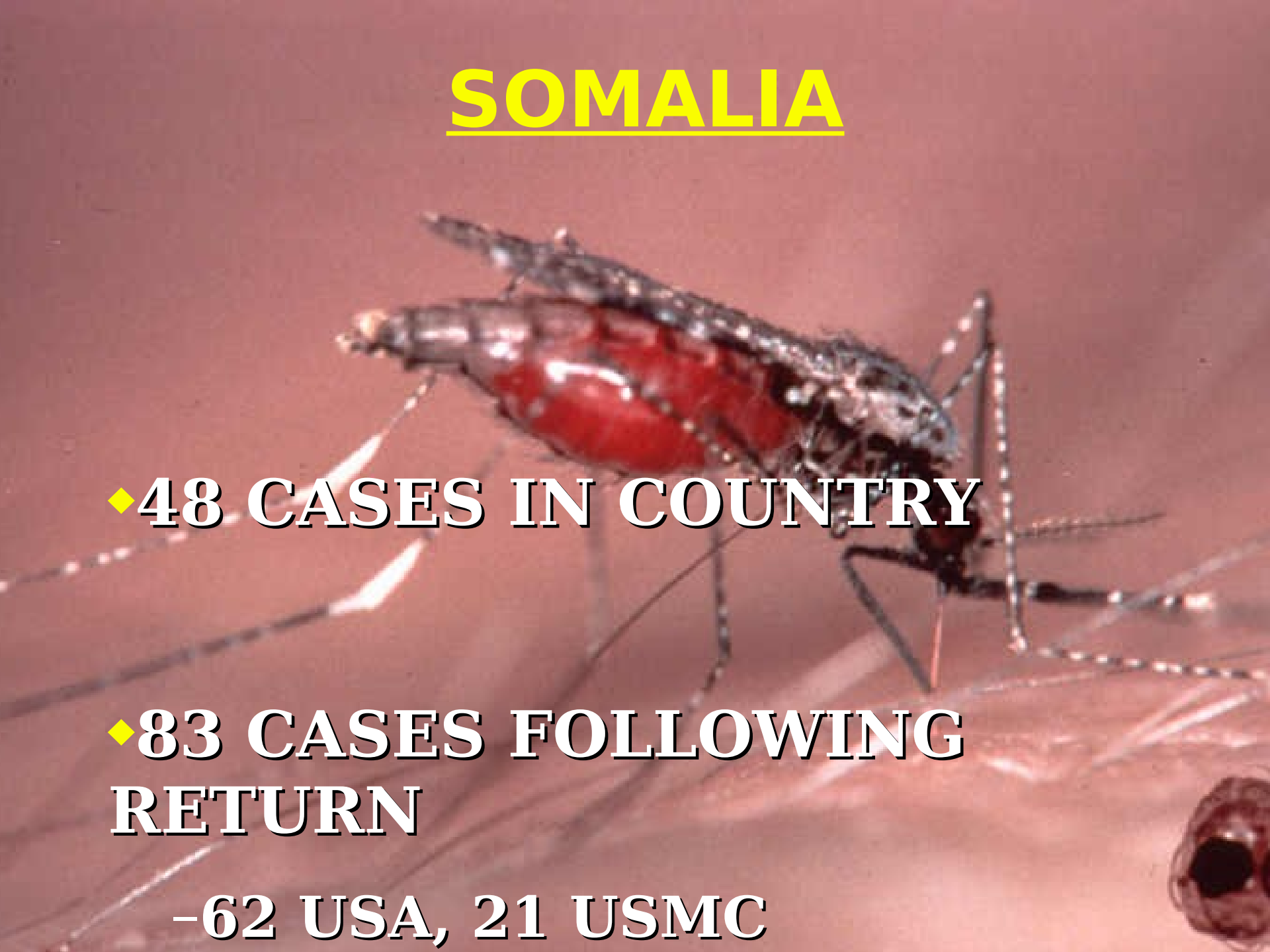
REDUCE CONTACT BETWEEN HUMANS AND MOSQUITOES

- PERSONAL PROTECTIVE MEASURES
  - PROPER WEA
  - DEET
  - PERMETHRIN
  - BED NETS

DECREASE MOSQUITO POPULATION

- **SURVEILLANCE OF MOSQUITO POPULATIONS**
- **ID AND ELIMINATION OF BREEDING SITES**
- **PROPER INSECTICIDE APPLICATION**
  - **ATTACK LARVAL STAGES**
  - **ATTACK ADULT MOSQUITO**

SOMALIA

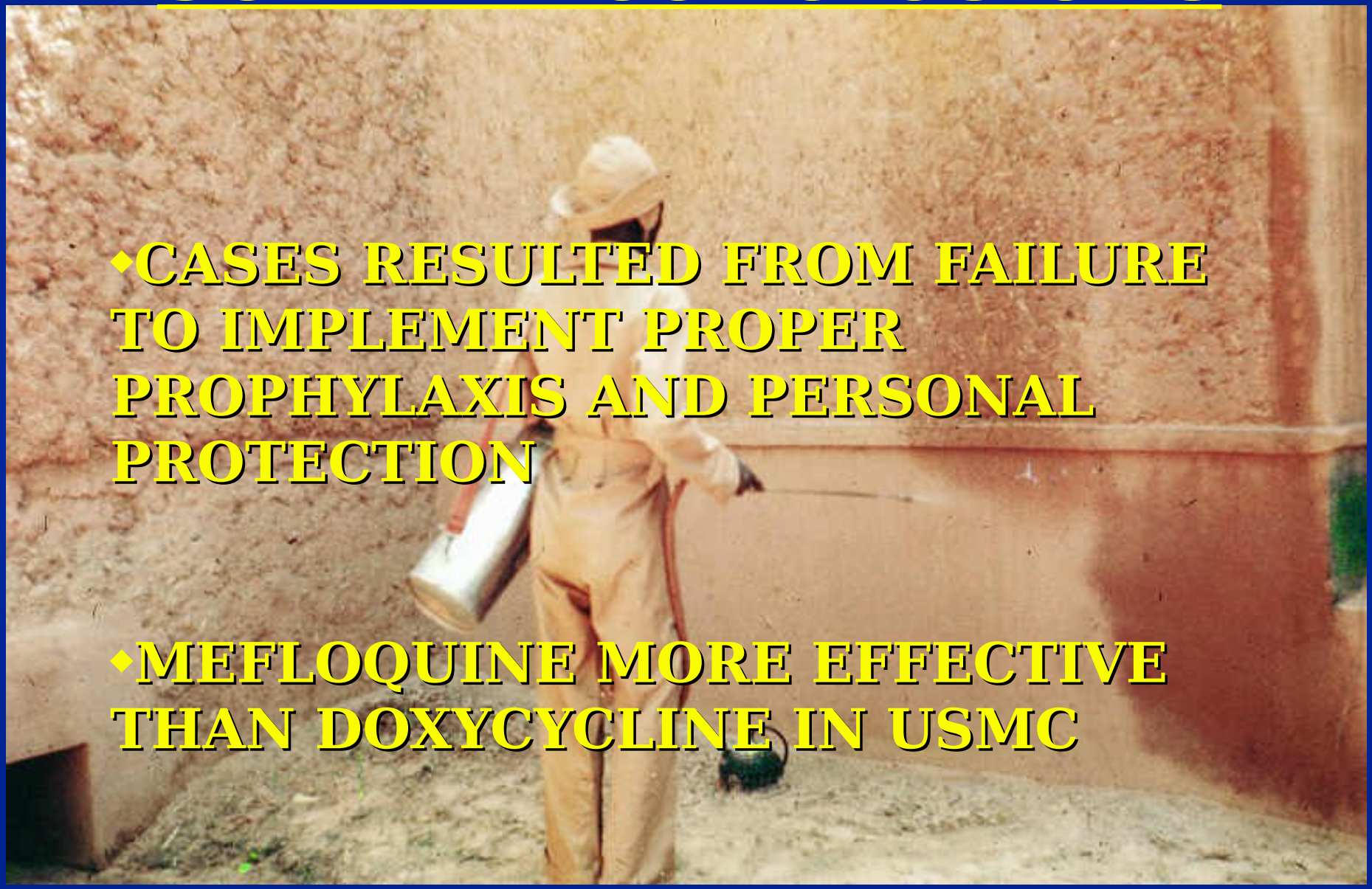


- 48 CASES IN COUNTRY
- 83 CASES FOLLOWING RETURN
  - –62 USA, 21 USMC

SOMALIA

- ISSUES
  - COMMAND RESPONSIBILITY
  - COMPLIANCE: SWITCH TO MEFLOQUINE
  - LOCATION OF CAMPS
  - WEATHER → POOR USAGE OF DEET
  - NON-USE OF BED NETS
  - PRIMAQUINE TERMINAL PROPHYLAXIS
    - USA HAD NOT RECOMMENDED

SOMALIA CONCLUSIONS



- CASES RESULTED FROM FAILURE TO IMPLEMENT PROPER PROPHYLAXIS AND PERSONAL PROTECTION
- MEFLOQUINE MORE EFFECTIVE THAN DOXYCYCLINE IN USMC

COMMAND RESPONSIBILITY

- Field Marshall Sir William Slim:

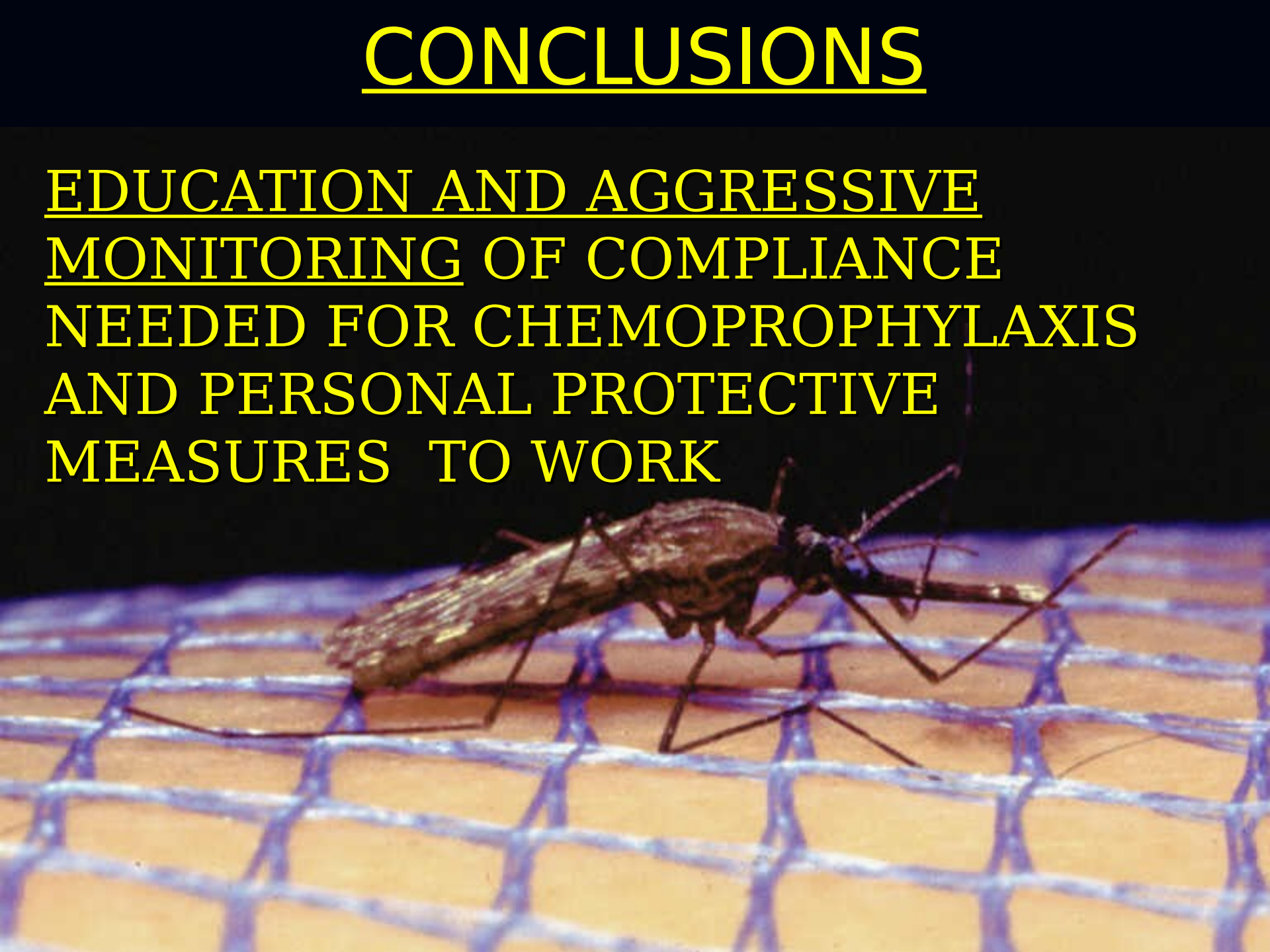
  "If the overall result was less than 95% positive, I sacked the commanding officer. I only had to sack three; by then the rest had got my meaning."

- Sir Neil Cantlie, Dir Gen Brit Army Med Services

  "When for the first time in history a combatant officer was considered unfit to command a unit on the grounds that he had allowed his men to become ineffective through disease, a new day in military medicine dawned. The clouds of forgetfulness must not be allowed to overshadow the brightness of that day."

CONCLUSIONS

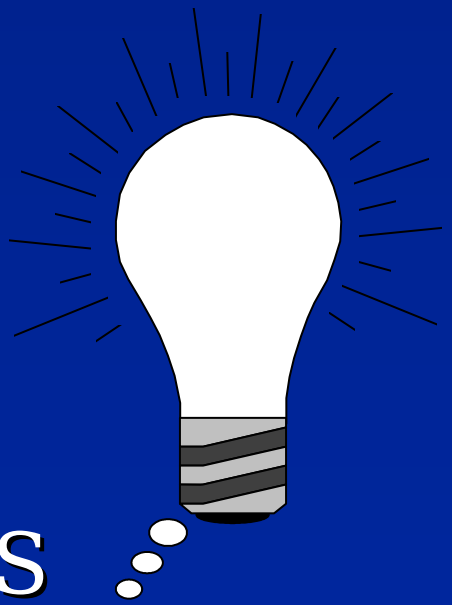
EDUCATION AND AGGRESSIVE MONITORING OF COMPLIANCE NEEDED FOR CHEMOPROPHYLAXIS AND PERSONAL PROTECTIVE MEASURES TO WORK



SUMMARY

- MALARIA DRUG RESISTANCE IS INCREASING
- GREAT IMPORTANCE OF **PERSONAL PROTECTIVE MEASURES**
- AGGRESSIVE MONITORING NEEDED TO ENFORCE PPM AT COMMAND LEVEL
- DX REQUIRES HIGH INDEX OF SUSPICION
- REGARD AND MANAGE MALARIA AS MEDICAL EMERGENCY

MALARIA!



- REMEMBER:

FLU-LIKE SYMPTOMS

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'RECENT' HX TRAVEL TO MALARIOUS AREA

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THINK MALARIA